CLAIMS

1. A method of reconstructing an image, the method comprising:

receiving a superposition of phase-weighted spin echoes, the superposition being representative of a two-dimensional spin density that encodes the image;

recovering a partial spin density from the superposition of spin echoes, the partial spin density being a PERL transform of the two-dimensional spin density; and

recovering the two-dimensional spin density from the partial spin density by analytically evaluating an inverse PERL transform of the partial spin density.

2. The method of claim **1**, wherein recovering the two-dimensional spin density comprises evaluating an integral of the partial spin density weighted by a bandwidth-limited eigenfunction orthogonal to the Bessel functions.

3. The method of claim **2**, further comprising selecting the bandwidth-limited eigenfunction to include an integral of a Chebycheff polynomial.

4. The method of claim **2**, further comprising selecting the bandwidth-limited eigenfunction to include a term represented by

$$M_m(ky) \equiv \frac{(-i)^m}{k\pi} \int_{-k}^{k} \cos\left(m \cos^{-1}\left(\frac{-\omega}{k} \right) \right) e^{-i\omega y} d\omega$$

where ω is a spatial angular frequency and k is a wave number.

5. A method of calibrating a PERL coil, the method comprising:

generating a Fourier encoded image having a phase encode gradient field that varies along a periodic direction of the PERL coil;

causing the PERL coil to generate a PERL field during a read-out time;

generating a Fourier reconstructed image, the reconstructed image having features indicative of a misalignment between the PERL field and the phase encode gradient field; and

adjusting an effective position of the PERL coil to reduce the mismatch.

6. The method of claim **5**, wherein adjusting an effective position comprises physically moving the PERL coil.

7. The method of claim **5**, wherein adjusting an effective position comprises varying current passing through the PERL coil.

8. A method of calibrating a PERL coil, the method comprising:

generating a Fourier encoded image having a phase encode gradient field that varies along a linear direction of the PERL coil;

causing the PERL coil to generate a PERL field during a read-out time;

generating a Fourier reconstructed image, the reconstructed image having features indicative of a mismatch between a magnitude of the PERL field and a magnitude of the phase encode gradient field; and

adjusting a current flowing on the PERL coil to reduce the mismatch.

9. An apparatus for generating a PERL field, the apparatus comprising:

a substrate having first and second layers;

a first trace pair having

a first conductive trace defining a first waveform on the first layer, the first waveform being spatially periodic in a periodic direction;

a second conductive trace defining a second waveform that is the mirror image of the first waveform;

the first and second conductive traces being electrically connected to each other;

a second trace pair electrically connected to the first trace pair, the second trace pair having

a third conductive trace defining a third waveform on the second layer, the third waveform being identical to the first waveform, the third conductive trace extending further than the first conductive trace along a linear direction orthogonal to the periodic direction;

a fourth conductive trace defining a fourth waveform on the second layer, the fourth waveform being identical to the second waveform, the fourth conductive trace extending further than the third conducting trace along the linear direction;

the third and fourth conductive trace being electrically connected to each other.

10. A system for generating a PERL field, the system comprising:

a first apparatus as recited in claim **9**,

a second apparatus as recited in claim **9**, the second apparatus being spatially offset from the first apparatus along the periodic direction.

11. An apparatus for generating a periodic component of a PERL field, the apparatus comprising:

a substrate having a first surface and a second surface opposed to the first surface;

a first conductive trace defining a first waveform on the first surface, the first waveform being spatially periodic in a periodic direction; and

a second conductive trace electrically connected to the first conductive trace, the second conductive trace defining a second waveform on the second surface, the second waveform being identical to the first waveform but spatially offset therefrom by a half of a spatial wavelength of the first waveform.